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THE BERMUDA ISLANDS.

A Contribution to the Physical History and Zoology of the Somers Archipelago. With an Examination of the Structure of Coral Reefs. By Angelo Heilprin, Curator-in-Charge and Professor of Invertebrate Palæontology at the Academy of Natural Sciences of Philadelphia, &c. With additions by Prof. J. P. McMurrich, Mr. H. A. Pilsbry, Dr. George Marx, Dr. P. R. Uhler, and Mr. C. H. Bollman. (Philadelphia: Published by the Author, 1889.)

THIS work is mainly the outcome of researches concerning the physical history, geology, and zoology of the Bermudas, which were accomplished under the auspices of the Academy of Natural Sciences of Philadelphia in the summer of 1888. The author's principal object was to satisfy his own mind on certain points connected with the structure of coral reefs, and but little zoological work was contemplated. Fortunately, however, the collection of zoological material proved more extensive than was expected, and in this respect Prof. Heilprin was greatly assisted by the students who accompanied him.

After a pleasant chapter of "general impressions," the author gives the results of his examination of these islands, and then proceeds to make such a vigorous attack on the views advanced by Agassiz, Murray, and their followers, concerning the origin of coral islands, that those attacked may be pardoned if they regard him as an apostle of the old belief.

Coming from the pen of Prof. Heilprin, this volume will, however, be welcomed by both sides in the controversy, but he must expect from his opponents an energetic reply to some of his criticisms, and an unmistakable dissent from some of his conclusions. Thus when the author asserts that the existence of an atoll in the present position of the Bermudas is not demonstrable, and that we have yet to learn to what form of coral structure these islands belong, he is at variance with most other authorities on the subject; and it becomes at the same time a little difficult to follow him in his conclusion that the results of his researches go to sustain the atoll-theory of Darwin. However, laying this difficulty aside, and accepting the fact, fairly established in this volume, that these islands have undergone recent movements, first of upheaval and then of subsidence, we may ask: "Of what use is this double testimony to any theory, whether of upheaval or of subsidence, unless a direct connection is first established between the form of a reef and the character of the movement?" The direct testimony of a single atoll that can be proved to have grown in a stationary area will, unless this connection be established, far outweigh the presumptive evidence derived from a slight subsidence of every atoll in the Indian and Pacific Oceans.

Dr. Rein, in the instance of the Bermudas, was the leader of one of the early skirmishes in this controversy, and it was to his description of these islands that the opponents of the atoll-theory of Darwin pointed in support of their views. They miss, therefore, in this book, any special exposition on the author's part of the relation of his own views to those of Dr. Rein. They also will fail to see how Murray's explanation of the origin of the inner basins of the Bermudas by solution can be met merely by a statement of contrary conviction unsupported by experimental proof. Nor will they agree with Prof. Heilprin's assertion that the recent memoir of Agassiz on the Hawaiian Islands can scarcely be said to contribute materially towards the solving of the problem.

The author in this volume treats as absurd my attempt to show that a true conception of the relative dimensions of an atoll is necessary to understand the nature of the problem. I was aware that, if my meaning was not understood, I should lay myself open to some curious reflections, and therefore the point is further elucidated in my description of the Keeling Islands, in the *Scottish Geographical Magazine*. To Prof. Heilprin's inquiry as to how near are we brought to an understanding of the character of an atoll by a true conception of its relative dimensions, I would answer with the query, "How far are we misled from the truth by the woefully-distorted sections of atolls that are employed by lecturers and by the authors of text-books?" Let me cite a single instance—that of Darwin's section of the Great Chagos Bank, which gives that atoll (which is 76 miles in width and 40 to 50 fathoms deep) the relative dimensions of a soup-plate. Some go further, and draw, with a free hand, a deep, saucer-shaped section of such reefs. Illustrations of this kind practically beg the question at the start, if we are arguing in favour of the theory of subsidence. The mind is at once informed by the eye that there is a deep basin to be accounted for, whereas a section on a true scale would exhibit no appreciable depression. In the exaggeration of the relative depth of an atoll is concerned the very essence of the problem, and a side-note cannot remove the impression made by a false section on the mind. Our conception of the problem can scarcely be assisted by a section of an atoll representing in the lagoon greater oceanic depths than the *Challenger* ever plumbed.

Passing from these controversial matters to the zoological section of this volume, we find a very interesting chapter on the relationship of the Bermudian fauna. The number of known species of marine Mollusca has been increased from 80 to about 170, none of the eleven species peculiar to Bermuda having been described before this exploration. Strangely enough, though "overwhelmingly Antillean in character," the marine Mollusca include a Pacific element. The land mollusks have been increased from about twenty to thirty species, of which eight appear to be confined to these islands; but, in explaining the mode of transport of the non-peculiar species, the author scarcely seems to have laid sufficient importance on the transporting agencies of commerce. A remarkable fact noted in connection with the Bermudian crustaceans is the occurrence of three macrurans—*Palæmonella tenuipes*, *Palæmon affinis*, and *Penæus velutinus*—hitherto only recorded from the Pacific. Prof. Heilprin arrives at some interesting conclusions in this chapter, and perhaps the most important one is connected with the large proportion of peculiar forms amongst the land-shells, a circumstance which is pointed to as evidence not only of the antiquity of a portion of

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the fauna, but also of its derivation from some pre-existing fauna in those islands. Much other zoological matter is to be found in this volume, though only a portion of the collections are here described. We are informed, however, that a great deal of systematic work still remains for the naturalist in the Bermudas, and Dr. Uhler, in respect of the insects, avers that much arduous collecting, particularly of the less conspicuous kinds, is still needed.

I do not know whether any argument for the considerable antiquity of the Bermudas from the character of the fauna has been advanced before. At all events, Prof. Heilprin's valuable suggestion opens up a line of inquiry in the case of coral islands generally, which might be pursued with profit. From investigations of the coral phenomena alone, I arrived at the conclusion that Keeling Atoll has a life-history of from 15,000 to 20,000 years, and that it is now in the last quarter of its existence. If this coral island is a type, then atolls must possess a high antiquity; and, taking our cue from Prof. Heilprin, we may ask whether, in the fauna and flora of a typical Pacific or Indian Ocean atoll, there is anything to suggest that they are derived from a pre-existing order of things. Confining ourselves to the flora, we find that oceanic atolls are mostly characterized by Hemsley as possessing no endemic element amongst their plants. Yet some of these large atolls must have once engirt, according to the theory of subsidence, a mountainous island possessing an upland flora, and, as in the case of the Fijis, not a few peculiar species. The islands formed on the encircling reef, just like the coral islands that often front the shore of a mountainous island in the Western Pacific, would possess, in addition to the common littoral plants, a number of plants derived from the slopes of the adjacent island. How comes it, then, that, if these large groups of oceanic atolls mark the disappearance of mountain-ranges, we find no sign of the vanished upland flora amongst the common littoral plants that are now brought by currents, winds, and sea-birds to every atoll? The Island of Tahiti could hardly disappear beneath the ocean without leaving a Tahitian impress on the flora of the surviving atoll. A similar reflection often occurred to me whilst on the Keeling Islands.

In conclusion, I would remark that partisanship in matters of scientific dispute cannot affect the value of this work by an American naturalist on one of the oldest of British possessions. The book is illustrated with several beautiful phototypes of general views in the islands, as well as of the æolian formations and of the coast scenery; and seventeen lithographic plates accompany the zoological descriptions. H. B. GUPPY.

THE USEFUL PLANTS OF AUSTRALIA.

The Useful Plants of Australia (including Tasmania). By J. H. Maiden, F.L.S., F.C.S., &c. (London: Trübner and Co. Sydney: Turner and Henderson. 1889.)

ALTHOUGH designed in the first instance as a hand-book to the specimens in the Technological Museum at Sydney, this work in its present form is really a concise text-book treating of "all Australian plants which, up to the present, are known to be of economic value, or injurious to man and domestic animals."

The literature of Australian economic botany may be said to date from the Great Exhibition of 1851. Owing, however, to the unsettled nomenclature of Australian plants previous to the publication of the great "Flora Australiensis," by Bentham and Mueller, the properties of the same plant were often found described under numerous botanical names. The publication of the "Flora," and the subsequent issue of Baron Mueller's "Census of Australian Plants" (with annual supplements), have now rendered species names easily accessible to workers in all parts of Australia, and the ground is well prepared for such a publication as that which lies before us. It is a bulky volume of 700 pages, well arranged, well got up, and furnished with an excellent index of botanical names, and also one of vernacular names. As Mr. Maiden reminds us, this is the first attempt made to grapple with the economical botany of Australia. He has wisely followed Baron Mueller in all essential details of classification, and due credit is given throughout the book to this learned and indefatigable worker, now, the greatest living authority on all that relates to Australian vegetable life. The arrangement of subjects has been adopted as that found most convenient in the Museum. This is not, perhaps, the best arrangement for a text-book, as it involves considerable repetition of names and synonyms under each section; but on that point we are not disposed to quarrel with the author. It opens, with human foods, and food adjuncts; and these are succeeded by forage plants, drugs, gums, resins and kinos, oils, perfumes, dyes, tans, timbers, fibres, and it closes with plants having miscellaneous uses not previously enumerated. A glance at the book shows very clearly, that if we except timbers, a description of which occupies about one-half the contents, the economic products of Australia are not of extraordinary importance. It is noticeable that the northern parts, where the flora is reinforced by representatives from the Malayan Archipelago and Southern Asia, yield most of the plants possessing medicinal properties. The genus Eucalyptus, comprising more than 130 species, yields excellent timber, kinos, and essential oils, and probably the chief economic products of Australia derived from native plants. Mr. Maiden has brought together practically all that is known about the industrial application of "gum"-trees, but we cannot now attempt to follow him.

Eucalyptus Gunnii (a large plant of which grows in the open air at Kew) yields a sweetish sap converted by settlers into an excellent cider. This, and manna, from *E. viminalis* and *E. dumosa* are probably the only food products derived from Eucalyptus trees. In the production of Eucalyptus oil (from *E. amygdalin* and *E. globulus*), Australia, it appears, has powerful competitors in Algeria and California, where gum-trees have been largely planted during the last twenty years. In the latter country, a large quantity is available as a by-product in the manufacture of anti-calcaire preparations for boilers.

The widely-spread Acacias of Australia, locally known as wattles, are hardly less useful than the gum-trees. Owing to the immense number destroyed for the sake of the bark used in tanning, the wattles in some districts are said to be threatened with extinction. Some whose leaves are eaten by stock are also becoming scarce. To counteract these influences, systematic attempts have been

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